

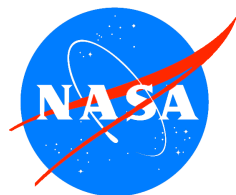
NASA SCIENCE MISSION DIRECTORATE

*Earth-Sun System Applied Sciences Program
Agricultural Efficiency Program Element
FY2006-2010 Plan*



Version: FINAL DRAFT

Date: 6/30/2006



*Expanding and accelerating the realization of economic and societal
benefits from Earth-Sun System science, information, and technology*

NASA Science Mission Directorate
Earth-Sun System Division
Applied Sciences Program

Applied Sciences for the Agricultural Efficiency Program Element:

This document contains the Agricultural Efficiency Program Element Plan for FY 2006-2010.

This plan derives from direction established in the NASA Strategic Plan, Earth Science Enterprise and Space Science Enterprise Strategies, Earth Science Applications Plan, and OMB/OSTP guidance on research and development. The plan aligns with and serves the commitments established in the NASA Integrated Budget and Performance Document.

The Program Manager and the Applied Sciences Program Leadership have reviewed the plan and agree that the plan appropriately reflects the goals, objectives, and activities for the Program Element to serve the Applied Sciences Program, Earth-Sun System Division, NASA, the Administration, and Society.

(Signature on file)

Ed Sheffner

Program Manager, Agricultural Efficiency

Applied Sciences Program

NASA Earth-Sun System Division

Date

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Lawrence Friedl

Lead, National Applications

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NASA Earth-Sun System Division: Applied Sciences Program

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NASA Science Mission Directorate – Applied Sciences Program

Agricultural Efficiency Program Element Plan: FY 2006 - 2010

I. Purpose and Scope

This Applied Sciences National Applications Program Element Plan is applicable for Fiscal Years 2006 through 2010. The plan documents the purpose of the program and the implementation approach to meet the program objectives using the allocated resources. The plan describes the program element approach in extending NASA Earth-Sun system science research results to meet the decision support requirements of partner agencies and organizations. The Applied Sciences Program requires this plan to function as a program management tool, describing the program structure, functional mechanisms, performance measures, and general principles that will be followed in extending NASA research results for societal benefits.

Scope within NASA and Applied Sciences Program

Each National Applications Program Element is managed in accordance with, and is guided by, the NASA Strategic Plan and Earth Science Applications Plan. The program element benefits from NASA Earth-Sun system science research results and capabilities, including the fleet of NASA research satellites, the predictive capability of models in the Earth System Modeling Framework (ESMF), Project Columbia, the Joint Center for Satellite Data Assimilation (JCSDA), and the Earth-Sun System Gateway (ESG). The Applied Sciences Program seeks to develop with its partners scientifically credible integrated system solutions in which uncertainty characterization and risk mitigation has been performed using the capability of the national Earth-Sun laboratories and others in the community of practice.

The FY06 President's Budget for the NASA Applied Sciences Program specifies between \$48 million and \$55 million annually for FY06 – FY10. There are two elements to the Applied Sciences Program: National Applications and Crosscutting Solutions. Each National Applications Program Element benefits from the performance results of Crosscutting Solutions (see Crosscutting Solutions Program Element Plan). Each National Applications Program Element leverages and extends research results from the over \$2 billion per year supporting Earth-Sun system science and development of innovative aerospace science and technology. Additional information about the NASA Applied Sciences Program can be found at <http://science.hq.nasa.gov/earth-sun/applications>.

Information on vegetation condition derived from remote sensing has long been used in decisions concerning agricultural production. Collaborations among the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of Agriculture (USDA) in the 1970's and 1980's (e.g., the Large Area Crop Inventory Experiment (LACIE), and Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing (AgRISTARS)) demonstrated that observations and measurements from Earth observing spacecraft provide valuable information on crop production, yield, and

condition. The technology and methodology that emerged from those programs contributes substantially to the global and domestic crop assessment work USDA conducts through the Foreign Agriculture Service (FAS) and the National Agricultural Statistics Service (NASS). FAS and NASS assessments are utilized by policy makers, agribusiness resource managers, and producers to make decisions on agricultural management affecting planting, harvesting, marketing, commodity export and pricing, drought monitoring, and food assistance. USDA administers a number of production, conservation, and environmental programs for American farmers regarding the sustainability of domestic agricultural production. Through USDA agencies such as the Farm Service Agency (FSA), the Natural Resource Conservation Service (NRCS), the Risk Management Agency (RMA), and others, programs are implemented and managed that enable the American agricultural producer to manage the perils associated with nature and markets while conserving, maintaining, and improving America's natural resources and environment. Management of many of these farmer-focused programs requires timely and accurate information on crop condition and weather--and longer-term climate predictions--that can be derived from existing and planned NASA Earth-Sun science missions and models. The Agricultural Efficiency Program Element focuses on enhancing the ability of NASA's partners to predict agricultural production and yield.

This program plan addresses such predictions primarily through integration of NASA capabilities, especially data and modeling capabilities in weather, climate, and natural hazards, into the global and domestic production and yield forecasting mandates of USDA. In the next decade, NASA contributions to decision support for agricultural efficiency will involve the transition of observations and measurements, from NASA experimental Earth observing platforms of proven utility in agriculture, to operational systems, and the evaluation of new observations and measurements for their value to enhance the performance of agricultural decision support tools. The current generation of NASA Earth-Sun System observations (e.g., Terra, Aqua, TRMM) and models have demonstrated their utility in decision support tools, and, where appropriate, enhancements to decision support tools based on NASA observations and model output are being incorporated into the operational procedures of users. NASA is assisting to ensure the continuity of observations and measurements with proven operational utility in operational follow-on instruments.

Observations and measurements from the new missions, (e.g., the Orbiting Carbon Observatory (OCO), and Aquarius) may also enhance the decision support systems and tools employed by USDA and other organizations with mandates to monitor agricultural efficiency. An example of NASA contributions to agriculture is the collaboration with the Foreign Agriculture Service (FAS) to improve the timeliness and accuracy of the information and predictions the FAS supplies to the World Agricultural Outlook Board (WAOB) in the board's monthly review of global agriculture. The inputs from FAS have an impact in the billions of dollars on agriculture decisions at all levels of agriculture – from individual operators to agribusiness and national agricultural policy and management. The collaboration between NASA and FAS is illustrative of the integrated system solutions that the Applied Sciences Program seeks with its partners (see Appendix A). USDA and NASA's Earth-Sun System Division are partners in a number of program elements that affect USDA mandates. The partnership is formally recognized in a Memorandum of Understanding (MOU) between NASA and USDA signed in May 2003. An interagency working group, authorized under the MOU, is meeting regularly to define collaborative projects in Agricultural Efficiency and other Earth-Sun System Division Applied Sciences Program Elements, including Carbon Management, Invasive Species, Air Quality, Water Management, Disaster Management, and Homeland Security. When identifying collaborative projects between USDA and NASA in Agricultural Efficiency, the requirements and contributions from the other program elements are considered by the interagency working group to ensure efficiency and prevent duplication of effort.

II. Goals and Objectives

Goals

NASA research on climate weather and natural hazards uses unique observations from space and predictive models to meet its research goals. Observations of land cover and land use, and change in both over time, the condition on vegetation, and direct measurements of parameters such as soil moisture, surface and atmospheric temperature and precipitation are potentially of great utility to agriculture. The spatial resolution of NASA observations and measurements make them particularly helpful in scaling up information on local conditions to make regional, continental and global assessments. In addition, NASA predictive modeling capabilities in weather and climate can be enhanced to provide regional input to models for agricultural productivity and yield. The long-term goal of the Agricultural Efficiency Program Element is to extend the use of NASA terrestrial and atmospheric observations, measurements, and predictive models to enhance the decision support tools of organizations with mandates for policy and management decisions affecting agriculture.

Objectives

All National Applications Program Elements are aligned to the NASA Strategic Plan and the agency's objectives as expressed in the NASA Integrated Budget and Performance Document (IBPD) and the Performance Assessment Rating Tool (PART).

FY06 Objectives:

1. FAS: Goddard Space Flight Center (GSFC) – Integration of MODIS and TRMM products into Global Agricultural Decision Support System
 - a. Complete validation and verification of MODIS and TRMM products in ARS crop model and for evaluation by FAS
 - b. Complete integration of MODIS and TRMM products in to Agricultural Information System (AIS) for delivery of products on demand to FAS and UN/WFP users.
 - c. Integrate crop model output into FAS and WFP operational procedures for evaluation and assessment
 - d. Benchmark use of MODIS TRMM products in FAS decision support tool.
2. FAS: University of Maryland – Application of NASA EOS MODIS Data buy FAS
 - a. With FAS, plan the transition to full FAS responsibility for operational implementation of the system to generate and supply the MODIS VI products to FAS analysts and make available to the public via CropExplorer.
 - b. Complete the operational implementation of rolling window MODIS VI composites.
 - c. Verify and validate a merged, synthetic MODIS/SPOT/AVHRR VI for use by FAS analysts
 - d. Complete the 500m MODIS crop mask and evaluate the product in the US.
 - e. Complete and verify a vegetation moisture stress index based on MODIS data products.
3. FAS GSFC – Lake and Reservoir Monitoring System

- a. Increase the quality and quantity of existing Topex/Poseidon and Jason-1 lake and reservoir elevation products
 - b. Enhance the existing system by increasing the range of targets and products available via the inclusion of new satellite data from the Topex-Tandem Mission and the NOAA Geosat Follow-On (GFO) mission.
 - c. Compile and update systems engineering report comprising an evaluation study, verification and validation exercises and benchmark the enhanced system.
4. USAID: NASA-Goddard Institute for Space Studies (GISS) - Integrating NASA Models and Missions into Climate and Agriculture DSS
- a. Complete an evaluation report for of current systems and procedures used by USAID for integration of weather and climate data into agricultural decision support
 - b. Conduct Scoping Mission to Uruguay and Central America to strengthen connections between NASA and DSS users, fine-tune data and database needs of user groups. This will improve team efficiency and communication, and allow greater feedback.
5. FAS: USDA/ARS - Integrate NASA's Global Soil Moisture Remote Sensing and Modeling Data into USDA's Global Crop Production Decision Support System (new project)
- a. Develop one year model of soil moisture using AMSR-E and MODIS observations
 - b. Streamline process for delivery of NASA soil moisture product to USDA
 - c. Complete processing of AMSR-E soil moisture data
 - d. Complete Land Information System, Ensemble Kalman Filter code for AMSR-E data analysis.
6. NRCS: Institute for Technology Development – Improving the RUSLE Model Using Remotely Sensed Crop Residue Maps
- a. Evaluate the uncertainty in the Revised Universal Soil Loss Equation (RUSLE) estimated soil loss and “soil conditioning index” using traditional model input parameters at various locations
 - b. Evaluate existing crop residue algorithms and image based products that can quantify crop residue consistently.
 - c. Evaluate uncertainty in RUSLE estimated soil loss and SCI using satellite based products
 - d. Verify and validate image products for use by NRCS in the RUSLE.

FY07 Objectives:

- 1) Verify and validate initial AMSR-E soil moisture products
- 2) Initiate project(s) to evaluate impact of OCO and Aquarius products on decision support tools
- 3) Initiate project to integrate NASA climate/weather models in agricultural decision support tools.
- 4) Complete transition of MODIS/TRMM products used by FAS to fully operational FAS system.
- 5) Complete evaluation report for FEWS DST

III. Program Management and Partners

A. Program Management

Program Manager
Agricultural Efficiency Program Element
Ed Sheffner
Applied Sciences Program
Science Mission Directorate
NASA Headquarters

Responsibilities:

- Development of and implementation of interagency agreements and partnerships with other organizations
- Program development including program plans and budgets
- Development and implementation of solicitations for Agricultural Efficiency tasks
- Primary responsibility for metrics, performance goals and other performance evaluation criteria
- Liaison to the Research Program in Earth–Sun System Division; North American Carbon Program (NACP); Climate Change Science Program (CCSP) and Climate Change Technology Program (CCTP).
- Liaison to the NASA/USDA Interagency Working Group for Earth Science Applications.
- Co-chair (with USGS) of the USGEO taskforce on Global Land Observsation System (GLOS)
- NASA representative on the Interagency Task Force on Science to Support Agriculture

Deputy Program Manager
Agricultural Efficiency Program Element
Rodney McKellip
Project Research Scientist
Applied Sciences Directorate
NASA Stennis Space Center (SSC)

Responsibilities:

- Management of Agricultural Efficiency tasks assigned to Stennis Space Center
- COTR or Studies Manager (as appropriate) for grants and cooperative agreements that address Agricultural Efficiency management and are funded through procurement at Stennis Space Center.
- Coordinator and liaison with Program element management for Agricultural Efficiency tasks at NASA centers.

B. Agricultural Efficiency Network & Partners

The Applied Sciences Program pursues partnerships with federal agencies and others that oversee land management decisions and policies that effect agricultural production and yield. The program includes, for technical support, NASA field centers; universities; non-government organizations and commercial entities; and local, state, and tribal organizations that implement agricultural efficiency policies through decision support systems and tools. The Program is a node in a network involved in agricultural efficiency. The network members enhance agricultural efficiency through information sources that provide managers and policy makers with the knowledge to allocate resources. Key nodes in the network and currently involved with the program element include:

NASA field centers:

John C. Stennis Space Center.....	Mr. Rodney McKellip et al
Goddard Space Flight Center.....	Dr. Steven Kempler, Dr Charon Birkett, et al
Goddard Institute of Space Studies.....	Dr. Cynthia Rosenzweig et al

Federal partners:

USDA/FAS.....	Dr. Glenn Bethel
USDA/FAS.....	Dr. Brad Doorn
USDA/Agricultural Research Service.....	Dr. Mark Weltz
USDA/World Agricultural Resources Board.....	Dr. Gerry Bange
USDA/National Agricultural Statistics Service.....	Dr. Roberta Pense
USDA/Cooperative State Research, Education and Extension Service	Dr. Ray Knighton
Department of State.....	Mr. Fernando Echavarria

Other organizations:

Institute for Technology Development.....	Dr. George May
Raytheon Corporation.....	Dr. Peter Gilruth
INIA (Uruguay).....	Dr. Walter Baethgen
SERVIR.....	Dr. Dan Irwin
UN World Food Programme.....	Dr. Leonard Milich

Universities:

George Mason University.....	Dr. Paul Houser
Mississippi State University.....	Dr. David Shaw, Dr. Roger King
University of Arizona.....	Dr. Charles Hutchinson
University of Maryland.....	Dr. Chris Justice
.....	Dr. John Townshend
University of Florida.....	Dr. Jim Jones
University of Missouri.....	Dr. Verne Kaupp

Utah State University.....	Dr. Phil Rasmussen
Virginia Polytechnic Institute.....	Dr. Randall Wynne
Idaho State University.....	Dr. Keith Weber
State University of New York - Syracuse.....	Dr. Jim Hassett
University of North Dakota.....	Dr. George Seielstad
DAACS and Earth Science Modeling Centers: None.	

IV. Decision Support Tools and Management Issues

Priority Decision Support Tools

PECAD/CADRE

PECAD/CADRE is the term that references the decision support tools and system employed by the Foreign Agricultural Service of the USDA to generate production and yield estimates of major, global agricultural commodities. Estimates from FAS are based on a combination of data sources including information on vegetation condition and water availability derived from data products generated from Earth observing satellites. The estimates from FAS are one source of information used by the World Agricultural Outlook Board when the board issues its official, monthly estimates of production and yield. The economic importance of the WAOB estimates is enormous. The collaboration between the Applied Sciences Program and USDA on the PECAD/CADRE decision support system began in FY03. A "baseline" report on the DSS was delivered to FAS early in FY04. MODIS products for evaluation by FAS analysts began flowing to FAS in the summer of 2003. Benchmarking of the improvements in the DSS from NASA and USDA, under the terms of the MOU described in Section I, are exploring new collaborative projects. It is expected that at least one new DSS will emerge from that collaboration and will be base-lined by the end of FY05.

ICASA

The International Consortium for Agricultural Systems Applications (ICASA) provides information to countries in Central and South America on agricultural production. NASA, through the Goddard Institute of Space Studies, proposes to enhance the ICASA decision support system through the incorporation of GISS global and regional climate models (GISS RCM and GISS MM5) supplemented by observational spacecraft observations of vegetation condition and precipitation. NASA's partners in the enhancement of this DSS include USAID, the Instituto Nacional de Investigacion Agropecuaria in Uruguay, Florida State University and Mississippi State University.

FEWS NET

DST operated by USAID to identify onset of famine conditions.

Potential Agricultural Efficiency Management Issues: FY06-FY10

The decision to stop the Hydros mission may have an effect on the program element as anticipation of the data on soil moisture was high. There is now more emphasis on projects evaluating AMSR-E data for soil moisture. This issues will likely remain of interest to the community.

Cross-Application Activities

The program consists of functional elements that contribute to all of the National Applications activities. The intention is to have the performance of these functions leverage accomplishments, and therefore the apparent resource investment, to the greatest extent possible into the National Applications partnerships. These functions are: Geoscience Standards and Interoperability, Human Capital Development, Integrated Benchmark Systems, and Solutions Networks. Examples of leveraged activities are:

- The Earth-Sun System Gateway is a "portal of portals" providing an access point through an Internet interface to all web-enabled NASA research results.
- A Solutions Networks capability to discover candidate configurations of NASA research results with the potential to improve partner's decision support systems.
- A Rapid Prototyping Capability to support NASA and partners in reducing uncertainty and testing the validity of NASA research results in decision support tools.
- Systems integration capability, knowledge tools and skilled human capital to help conduct studies on the systematic transitioning of the results of research to operational uses and the capability of operational systems to support scientific research.
- A student-based, human capital development program for building capability in entry level participants in the community of practice while developing solutions for state and local applications.

V. Application Activities

A. Projects

All National Applications Program Elements authorize peer-reviewed projects to support each element's goal and objectives. To secure funding and authorization to undertake activities supporting NASA and the Applied Sciences Program, project teams are responsible for developing project plans and managing the activities. The project plans specify the Earth-Sun observations, models, and other research results to extend to decision support tools as well as the activities to produce appropriate deliverables. The plans integrate contributions from appropriate the partners, NASA Centers and other contributors from the community of practice. Projects are expected to extend the benefits of NASA research results to the maximum extent possible, including the use observations from sensors on: Aura, Terra, Aqua, TRMM, NPP, NPOESS, Hydros, Topex, Jason, OCO and Aquarius.

B. Solicitations

The Applied Sciences Program utilizes full and open competitions to fund proposals from the community to contribute the Agency's objectives. This implementation strategy will continue to be critical part of extending the benefits of NASA Earth-Sun system research results and contributing to the improvement of future operational systems. The Program has participated in providing opportunities to the community in recent solicitations, including REASoN, Decisions 2004, and Decisions under ROSES. The proposals related to this National Applications Program Element that have been funded under these solicitations are described in Section V.D. Program Element Projects.

C. Congressionally Directed Activities

As of the publication of this document, an assignment of FY06 congressionally mandated activities was not completed by the Agency.

The procurement rules and management practices of the Agency require that congressionally mandated activities follow the same principles of planning and accountability as all other funded projects. Only activities that are aligned with NASA's mission, are technically credible, and are appropriately budgeted will be approved to receive funding from the Program. The project teams of congressionally mandated activities are responsible for developing project plans and managing the activities.

D. Program Element Projects

Included below are the brief descriptions of the funded projects managed under this National Applications Program Element. Complete and detailed descriptions are documented in the Project Plans for each activity.

Project: University of Maryland Enhancement of FAS DSS					Solicitation	
The goal of this project is to enhance the decision support capabilities of the Foreign Agricultural Service in USDA through the integration of NASA MODIS products into the PECAD/CADRE decision support system. FY05 - 1) Rapid Response MODIS data: Produce alternative band combination products, including VI's for Rapid Response subsets. Test compositing methods for Rapid Response data. Add new regions for FAS analysis. 2) Assist in benchmarking Rapid Response product in FAS/PECAD system. 3) MODIS standard products: Test inclusion of other MODIS data streams with the interface (EVI, NBARS, etc.), including individual bands. Begin ingest of AVHRR and SPOT records. Add more geographic regions of interest for analysis. Consider needs for transitioning for VIIRS implementation. 4) Multi-sensor integration - Continue normalization of VI's from all instruments using one reference to allow for standard time series anomaly calculations.				Budget (\$K)		
				Procurement		
				FY06	0	
Project Manager	Centers	Timeframe	Partners	FY07	0	
Rodney McKellip	SSC (Lead), GSFC	FY03 - FY06	USDA/ FAS	FY08	0	
				FY09	0	
				FY10	0	
Earth Science Products	MODIS			Other Apps.		
Deliverables	Description		End Date	IBPD Metric #		
	Evaluation Report		1/1/2001			
	Design & Implement		12/1/2004			
	Verification and Validation Report		6/30/2005			
	Benchmark Report		9/30/2005			
	Conference Proceedings		2/1/2006			
	Project Plan		10/1/2005			
Notes: Three year project scheduled to end and funded through 2/14/06						

Project: USAID Agricultural Condition DST					Directed Project	
This project will plan the integration of NASA global and regional climate models, TRMM precipitation data and MODIS vegetation data into a regional decision support system for land resource management, agriculture and climate in support of USAID programs and missions.				Budget (\$K)		
				Procurement		
				FY06	168	
Project Manager	Centers	Timeframe	Partners	FY07	0	
Rodney Mckellip	GSFC	FY06 - FY06	USAID, Columbia Univ., SECC, IRI, SERVIR	FY08	0	
				FY09	0	
				FY10	0	
Earth Science Products	MODIS, TRMM, GISS RCM and MM5 models			Other Apps.		
Deliverables	<u>Description</u>		<u>End Date</u>	<u>IBPD Metric #</u>		
	Evaluation Report		9/30/2006			
	Design & Implement					
	Verification and Validation Report					
	Benchmark Report					
	Project plan meeting		2/1/2006			
	Develop collaboration with USAID		4/1/2006			
	Scoping mission		8/1/2006			
Notes:						

Project: Soil Moisture in Crop Forecast DSS					Solicitation	
Integrate NASA's global soil moisture remote sensing and modeling data into USDA's global crop production DSS				Budget (\$K)		
				Procurement		
				FY06	281	
Project Manager	Centers	Timeframe	Partners	FY07	293	
Rodney McKellip	GSFC	FY06 - FY08	USDA,/ARS/FAS, Univ. of Melbourne, GMU	FY08		
				FY09		
				FY10		
Earth Science Products	AMSR-E, MODIS, LDAS			Other Apps.		
Deliverables	<u>Description</u>		<u>End Date</u>	<u>IBPD Metric #</u>	Disaster Management	
	Evaluation Report		1/31/2006			
	Design & Implement		4/1/2006			
	Verification and Validation Report		9/30/2007			
	Benchmark Report		9/30/2008			
Notes:						

Project: Famine Early Warning Decision Support Tool					Solicitation	
Enhancement to the FEWS Net decision support tool used by USAID to monitor famine conditions in 28 countries. The enhancements include: 1) MODIS/ANHRR NDVI, TRMM/GPCP/CMAP precepitation and MODIS atmopsheric humidity to estimate critical parameters for water avialability four months in advance; 2) monitoring crop condition using MODIS 250 m and Landsat 30m reflectance data				Budget (\$K)		
				Procurement		
				FY06	397	
Project Manager	Centers	Timeframe	Partners	FY07	407	
Rodney Mckellip	GSFC, SSC	10/1/20 - 9/30/20	USAID, NOAA, SSAI, UCSB, USGS	FY08		
				FY09		
				FY10		
Earth Science Products				Other Apps.		
Deliverables	Description	End Date	IBPD Metric #	Disaster Management, Public Health		
	Evaluation Report	4/1/2006				
	Design & Implement					
	Verification and Validation Report	10/1/2007				
	Benchmark Report	9/30/2008				
	Begin V and V	10/1/2006				
Notes: Managed through public health						

Project: Integrating MODIS and VIIRS NPP Observations Into the USDA FAS Decisions System					Solicitation	
This project has three objectives: 1) Continue enhancements to MODIS products for PECAD decisions support tool and make the enhanced products available to FAS for evaluation; 2) integrate VIIRS products (replacements for MODIS0 into the PECAD system and benchmark the use of those products, and 3) Complete the operational transition to USDA FAS.				Budget (\$K)		
				Procurement		
				FY06	425	
Project Manager	Centers	Timeframe	Partners	FY07	425	
Rodney Mckellip	SSC (lead) GSFC	FY06 - FY08	USDA/FAS, South Dakota State Univ.	FY08		
				FY09		
				FY10		
Earth Science Products	MODIS VI & equivalent VIIRS prods. For operational transition - Topex/Poseidon & Jason-1 prods for lake and reservoir leves, potentially MODIS & TRMM prods from GSFC MODIS project			Other Apps.		
Deliverables	<u>Description</u>		<u>End Date</u>	<u>IBPD Metric #</u>		
	Evaluation Report					
	Design & Implement					
	Verification and Validation Report					
	Benchmark Report		12/1/2008			
	Complete phase 1 op trans plan		8/1/2006			
	Complete & eval 500m crop mask		6/1/2006			
	Expand near real time MODIS cvg		9/1/2006			
	Calib SPOT/MODIS/AVHRR VI		1/1/2007			
	V and V for calibrated product		6/1/2007			
	VIIRS data V and V		9/30/2008			
Complete operational transfer		12/1/2008				
Notes:						

Project: Integrating NASA Earth Science Enterprise Data into Global Agricultural Decision Support Systems					Solicitation	
Integrate MODIS and TRMM soil moisture and precipitation products into the USDA/FAS PECAD decision support tool. make the products available to FAS on-line and benchmark the use of the products.				Budget (\$K)		
				Procurement		
				FY06	313	
Project Manager	Centers	Timeframe	Partners	FY07	100	
Rodney Mckellip	SSC (lead) GSFC	FY03 - FY07	USDA/ARS/FAS, GMU, UN/WFP, SSAI	FY08		
				FY09		
				FY10		
Earth Science Products	MODIS, TRMM, TOVAS			Other Apps.		
Deliverables	<u>Description</u>		<u>End Date</u>	<u>IBPD Metric #</u>		
	Evaluation Report		1/1/2006			
	Design & Implement		4/1/2006			
	Verification and Validation Report		6/1/2006			
	Benchmark Report		9/30/2006			
	Complete crop model assessment		1/1/2006			
	Compl MODIS 10 day precip prod		4/1/2006			
	V and V for crop model		6/1/2006			
Notes: Project augmented in FY06-07						

Project: Enhancement and Expansion of the Near-real Time Lake and Reservoir Monitoring System					Solicitation	
This project will enhance the near real time capabilities for lake and reservoir monitoring from satellite based systems. Such a capability was benchmarked in FY05 for use by USDA/FAS. In FY06 the system will be enhanced by: 1) increasing the quality and quantity of Topex Poseidon and Jason-1 elevation products; 2) increasing the range of products available by adding the NASA/CNES Topex-Tandem Mission; and, 3) verification and validation of the enhanced and new products.				Budget (\$K)		
				Procurement		
				FY06	0	
Project Manager	Centers	Timeframe	Partners	FY07		
Rodney McKellip	SSC (lead) GSFC	FY06 - FY06	GSFC, Univ. of Maryland, Raytheon,	FY08		
				FY09		
				FY10		
Earth Science Products	Topex/Poseidon, Jason-1, Topex-Tandem			Other Apps.		
Deliverables	Description		End Date	IBPD Metric #		
	Evaluation Report		6/1/2006			
	Design & Implement					
	Verification and Validation Report		9/30/2006			
	Benchmark Report					
	Enhance & eval Jason-1 products		6/1/2006			
	Gen & eval Topex-Tandem prods		6/1/2006			
	Updated V and V report		9/30/2006			
					Public health, disaster management	
Notes: One year project from "Decisions" augmentation. FY05 funding with work performed in FY06.						

Project: Improving the RUSLE Model Using Remotely Sensed Crop Residue Maps					Solicitation	
Evaluate use of satellite based products to locate and monitor crop residue and refine model inputs used to determine eligibility and compliance with national conservastion programs.				Budget (\$K)		
				Procurement		
				FY06	0	
Project Manager	Centers	Timeframe	Partners	FY07		
Rodney Mckellip	SSC (lead)	FY06 - FY06	SSC, ITD, USDA/NRCS	FY08		
				FY09		
				FY10		
Earth Science Products	Landsat, ASTER			Other Apps.		
Deliverables	<u>Description</u>		<u>End Date</u>	<u>IBPD Metric #</u>		
	Evaluation Report		6/1/2006			
	Design & Implement					
	Verification and Validation Report		8/1/2006			
	Benchmark Report					
	Eval uncertainty RUSLE soil loss		4/1/2006			
	Eval satellite prods for model input		6/1/2006			
	V and v of satelite products					
	Integration of prods into user procs		9/30/2006			
Notes: Funded through augementation to "Decisions" awards. FY05 funding with work perfomed in FY06						

Project: Forecasting Rangeland Condition in Southeastern Idaho					Congressionally Mandated	
This project has four objectives that address rangeland condition and prediction: 1) examine severe drought effects relative to livestock grazing; 2) model and monitor rangeland condition; 3) forecast rangeland condition using cellular automata and markov chain analysis; and, 4) Public outreach				Budget (\$K)		
				Procurement		
				FY06	0	
Project Manager	Centers	Timeframe	Partners	FY07		
David Toll	GSFC	FY06 - FY08	Idaho State University, State of Idaho	FY08		
				FY09		
				FY10		
Earth Science Products	ASTER, MODIS			Other Apps.		
Deliverables	<u>Description</u>		<u>End Date</u>	<u>IBPD Metric #</u>		
	Evaluation Report					
	Design & Implement					
	Verification and Validation Report		6/1/2007			
	Benchmark Report					
	GISderived surface moisture model		1/1/2007			
	Compl rangeland health mod procs		3/1/2007			
	Verify and validate model output		6/1/2007			
Compl rangeland health model		9/30/2007				
Notes: This project is funded entirely from FY05 funds but the work will be completed over three years.						

Project: Northern Great Plains Center for People and the Environment					Congressionally Mandated	
This project entails a number of tasks related to agriculture, invasive species and carbon management.				Budget (\$K)		
				Procurement		
				FY06	0	
Project Manager	Centers	Timeframe	Partners	FY07		
Rodney Mckellip	SSC (lead)	FY06 - FY06		FY08		
				FY09		
				FY10		
Earth Science Products	MODIS, ASTER, AVHRR			Other Apps.		
Deliverables	<u>Description</u>			<u>End Date</u>	<u>IBPD Metric #</u>	Carbon management, invasive species
	Evaluation Report					
	Design & Implement					
	Verification and Validation Report					
	Benchmark Report					
Notes: Tasks perfomed in FY06 supporteed with FY05 funds.						

Project: Kentucky/USFS Forest Accounting					Solicitation	
				Budget (\$K)		
				Procurement		
				FY06	281	
Project Manager	Centers	Timeframe	Partners	FY07		
Bill Graham	SSC (lead)	FY03 - FY07	Kentucky, USFS	FY08		
				FY09		
				FY10		
Earth Science Products				Other Apps.		
Deliverables	<u>Description</u>			<u>End Date</u>	<u>IBPD Metric #</u>	
	Evaluation Report					
	Design & Implement					
	Verification and Validation Report					
	Benchmark Report					
Notes: REASoN CAN						

Project: Agricultural Efficiency Team Meeting				Project Management	
Annual meeting to review and discuss goals and objectives in the agrciultrual efficiency program element. Review progress and approaches toward collaborations with operational partners and effective mechanisms for improving decsions support tools through NASA research capabilities.				Budget (\$K)	
				Procurement	
				FY06	20
Project Manager	Centers	Timeframe	Partners	FY07	20
Ed Sheffner	ARC, GSFC, JSC, MSFC, SSC	FY06 - FY10	Univ. of Arizona, Univ. of Missouri	FY08	20
				FY09	20
				FY10	20
Earth Science Products				Other Apps.	
Deliverables	<u>Description</u>			<u>End Date</u>	<u>IBPD Metric #</u>
	Evaluation Report				
	Design & Implement				
	Verification and Validation Report				
	Benchmark Report				
	Plan for joint meeting w/ CM&IV	3/1/2006			
	Joint program planning session	6/1/2006			
	Final report on session	9/1/2006			
				Carbon management, invasive species and ecological forecasting	
Notes: Joint meeting with carbon management, invasive species, and, possibly, ecological forecasting program elements.					

Project: NASA/USDA Interagency Working Group on Earth Science Applications					Project Management	
Support activiites of the NASA/USDA Interagency Working Group.					Budget (\$K)	
					Procurement	
					FY06	5
Project Manager	Centers	Timeframe	Partners	FY07	5	
Ed Sheffner	SSC, GSFC	FY06 - FY10	USDA	FY08	5	
				FY09	5	
				FY10	5	
Earth Science Products					Other Apps.	
Deliverables	<u>Description</u>			<u>End Date</u>	<u>IBPD Metric #</u>	
	Evaluation Report					
	Design & Implement					
	Verification and Validation Report					
	Benchmark Report					
Notes:						

Project: USGEO on Global Agriculture				Project Management	
Provide input and support for the US Grtoup on Earth Observations activites related to global agrciulture inlcuding the Global Land Observing System.				Budget (\$K)	
				Procurement	
				FY06	10
Project Manager	Centers	Timeframe	Partners	FY07	10
Ed Sheffner		FY06 - FY10	Participants in USGEO	FY08	10
				FY09	10
				FY10	10
Earth Science Products				Other Apps.	
Deliverables	<u>Description</u> Evaluation Report Design & Implement Verification and Validation Report Benchmark Report			<u>End Date</u> <u>IBPD Metric #</u>	
Notes:					

Project: Conference Support				Project Management	
Co-sponsorship of conferecnes in which NASA contributions to decison support in agriculture are and/or discussed.				Budget (\$K)	
				Procurement	
				FY06	15
Project Manager	Centers	Timeframe	Partners	FY07	15
Ed Sheffner		-		FY08	15
				FY09	15
				FY10	15
Earth Science Products				Other Apps.	
Deliverables	<u>Description</u>			<u>End Date</u>	<u>IBPD Metric #</u>
	Evaluation Report				
	Design & Implement				
	Verification and Validation Report				
	Benchmark Report				
Notes:					

Project: REASoN - CADRE/PECAD (GSFC)					Directed Project	
					<i>Budget (\$K)</i> <i>Procurement</i>	
					FY06	
<i>Project Manager</i>	<i>Centers</i>	<i>Timeframe</i>	<i>Partners</i>	FY07		
Ed Sheffner		-		FY08		
				FY09		
				FY10		
<i>Earth Science Products</i>				<i>Other Apps.</i>		
<i>Deliverables</i>	<u><i>Description</i></u>	<u><i>End Date</i></u>	<u><i>IBPD Metric #</i></u>			
	Evaluation Report	Complete				
	Design & Implement	6/30/2005				
	Verification and Validation Report	9/30/2005				
	Benchmark Report	9/30/2005				
	Project Plan	10/1/2005				
<i>Notes:</i>						

E. Additional Activities & Linkages

The program consists of functional elements that contribute to all of the National Applications activities. The intention is to have the performance of these functions leverage accomplishments, and therefore the apparent resource investment, to the greatest extent possible into the National Applications partnerships. These functions are: Geoscience Standards and Interoperability, Human Capital Development, Integrated Benchmark Systems, and Solutions Networks.

NASA and Science Mission Directorate Priorities

- Federal Enterprise Architecture (FEA) is a business and performance-based framework to support cross-agency collaboration, transformation, and government-wide improvement.
- The Global Information Grid (GIG) is the first stage of a U.S. military global, highbandwidth, Internet protocol-based communications network (a.k.a., 'the Internet in space').
- The Joint Center for Satellite Data Assimilation (JCSDA) is a multi-agency collaboration to accelerate and improve the quantitative use of research and operational observational spacecraft data in weather and climate prediction models. NOAA (NESDIS, NWS, OAR), NASA, Navy, Air Force, and NSF (through UCAR) collaborate in JCSDA.
- Metis is a visual modeling software tool for planning, developing, and analyzing agencies' enterprise architectures. The Applied Sciences Program is using Metis to identify possible linkages between observations, models, and decision support tools to support the IWGEO and NASA/NOAA R2O activities.
- Observing System Simulation Experiments (OSSEs) use simulated observations to assess the impacts of future observational spacecraft instruments on weather and climate prediction and provide opportunities to test new designs and methodologies for data gathering and assimilation.
- Project Columbia is a NASA-wide project to develop a new, fast supercomputer (using an integrated cluster of interconnected processor systems) to support the Agency's mission and science goals, including enhanced predictions of weather, climate, and natural hazards.

E. IBS Request

- USAID agricultural production and yield prediction system.
- MODIS/TRMM soil moisture and precipitation products
- Topex/Poseidon, Topex-Tandem and Jason-1 lake and reservoir elevation products
- MODIS 500m crop land mask 4) RUSLE crop residue products
- MODIS/TRMM soil moisture and precipitation products
- A Rapid Prototyping Center is a proposed center at Stennis to support NASA and partners in testing and verification of Earth science results in decision support tools.
- Transition from Research to Operations Network (R2O) is a network that focuses on systematically transitioning the results of research to operational uses.

Program Response to IBS Request

To be supplied by program management.

E. Crosscutting Request

DEVELOP is a student-based program for rapidly prototyping solutions for state and local applications and helping students develop capabilities related to applied Earth-Sun science.

The Earth-Sun System Gateway is a "portal of portals" providing an access point through an Internet interface to all web-enabled NASA research results.

Program Response to Crosscutting Request

To be supplied by program management.

VI. Budget: FY06-2010

The following table lists the Agricultural Efficiency Program budget (procurement) for FY2006:

<u>Project</u>	FY06 Procurement Allocation (\$K)
University of Maryland Enhancement of FAS DSS	\$ 0
USAID Agricultural Condition DST	\$ 168
REASoN - CADRE/PECAD (GSFC)	\$ -
Soil Moisture in Crop Forecast DSS	\$ 281
Famine Early Warning Decision Support Tool	\$ 397
Integrating MODIS and VIIRS NPP Observations Into the USDA FAS Decisions System	\$ 425
Integrating NASA Earth Science Enterprise Data into Global Agricultural Decision Support Systems	\$ 313
Enhancement and Expansion of the Near-real Time Lake and Reservoir Monitoring System	\$ 0
Improving the RUSLE Model Using Remotely Sensed Crop Residue Maps	\$ 0
Forecasting Rangeland Condition in Southeastern Idaho	\$ 0
Northern Great Plains Center for People and the Environment	\$ 0
Kentucky/USFS Forest Accounting	\$ 281
Agricultural Efficiency Team Meeting	\$ 20
NASA/USDA Interagency Working Group on Earth Science Applications	\$ 5
USGEO on Global Agriculture	\$ 10
Conference Support	\$ 15

Total = \$ 1915

Appendix C lists program-wide budget allocations for FY2006-10.

VII. Program Management and Performance Measures

The Agricultural Efficiency Management Team uses performance measures to track progress, identify issues, evaluate projects, make adjustments, and establish results of the Program Element. The Program's Goals and Objectives (Section II) state what the program intends to achieve. These measures help monitor progress within and across specific activities to ensure the program meets its goals and objectives. The management team analyzes these measures retrospectively in order to make adjustments prospectively to the program approach and objectives.

The measures are in two categories. Program Management measures are internally focused to assess the activities within the program. Performance measures are externally focused to assess if the program activities are serving their intended purpose. In general, the program manager uses these measures to evaluate the performance of activities conducted and sponsored by the program, especially the projects. In addition, the Earth-Sun System Division's Applied Sciences Program uses this information in preparing IBPD directions and PART responses.

Program Management Measures (Internal):

Inputs:

- 1) Potential issues and DSTs identified for agricultural efficiency - number, type, range
- 2) Eligible partners to collaborate with - number, type, range
- 3) Potential results/products identified to serve agricultural efficiency - number, type, range

Outputs:

- 1) Assessments or evaluations of DSTs - number, range
- 2) Assessments of Earth-Sun science results/products to serve DSTs - number, range
- 3) Agreements with partners - presence
- 4) Reports (evaluation, validation, benchmark) - number, type

Quality and Efficiency:

- 1) Earth-Sun science results/products - number used per DST, ratio of utilized to potential
- 2) Agreements - ratio of agreements to committed partners
- 3) Reports - partner satisfaction, timeliness, time to develop
- 4) Reports - ratio of validations to potential products, ratio of benchmarks to validations

Performance and Results Measures (External):

Outcomes:

- 1) Applied Sciences products adopted in DSTs - number, type, range; use in DST over time
- 2) Earth-Sun science products in use - ratio of products used by partners to reports produced
- 3) Partner & DST performance - change in partner DST performance, number and type of public recognition of use & value of Earth-Sun science observations in DST

Impacts:

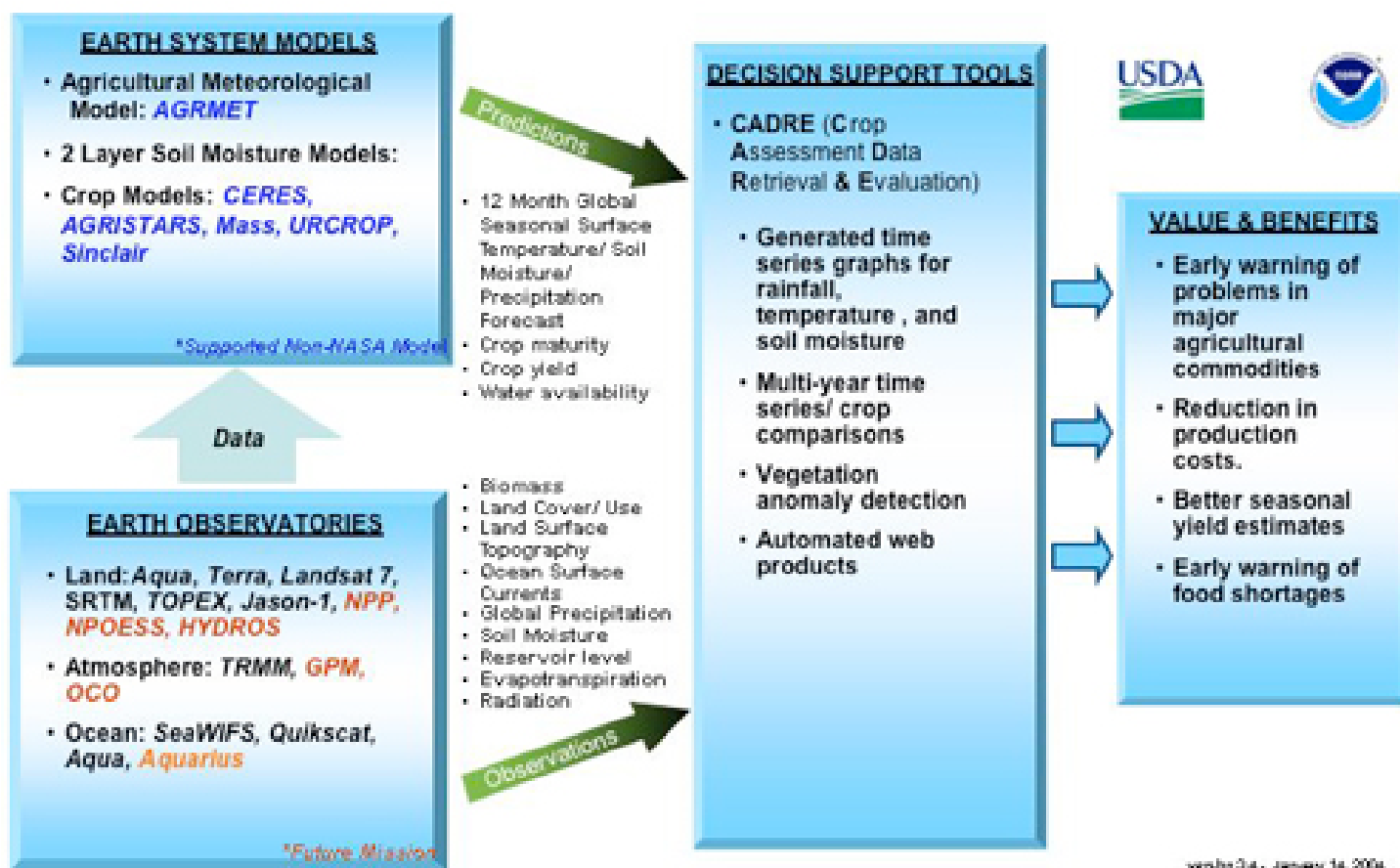
- 1) Partner value - change in partner metrics (improvements in value of partner decisions)

In addition to the stated measures, the Agricultural Efficiency Program Element manager periodically requests an assessment of plans, goals, priorities, and activities through external review. The Agricultural Efficiency Program Element team uses these measures along with comparisons to programmatic benchmarks to support assessments of the Earth-Sun Division Applied Sciences Program (e.g. internal NASA reviews and OMB PART).

VIII. Appendices

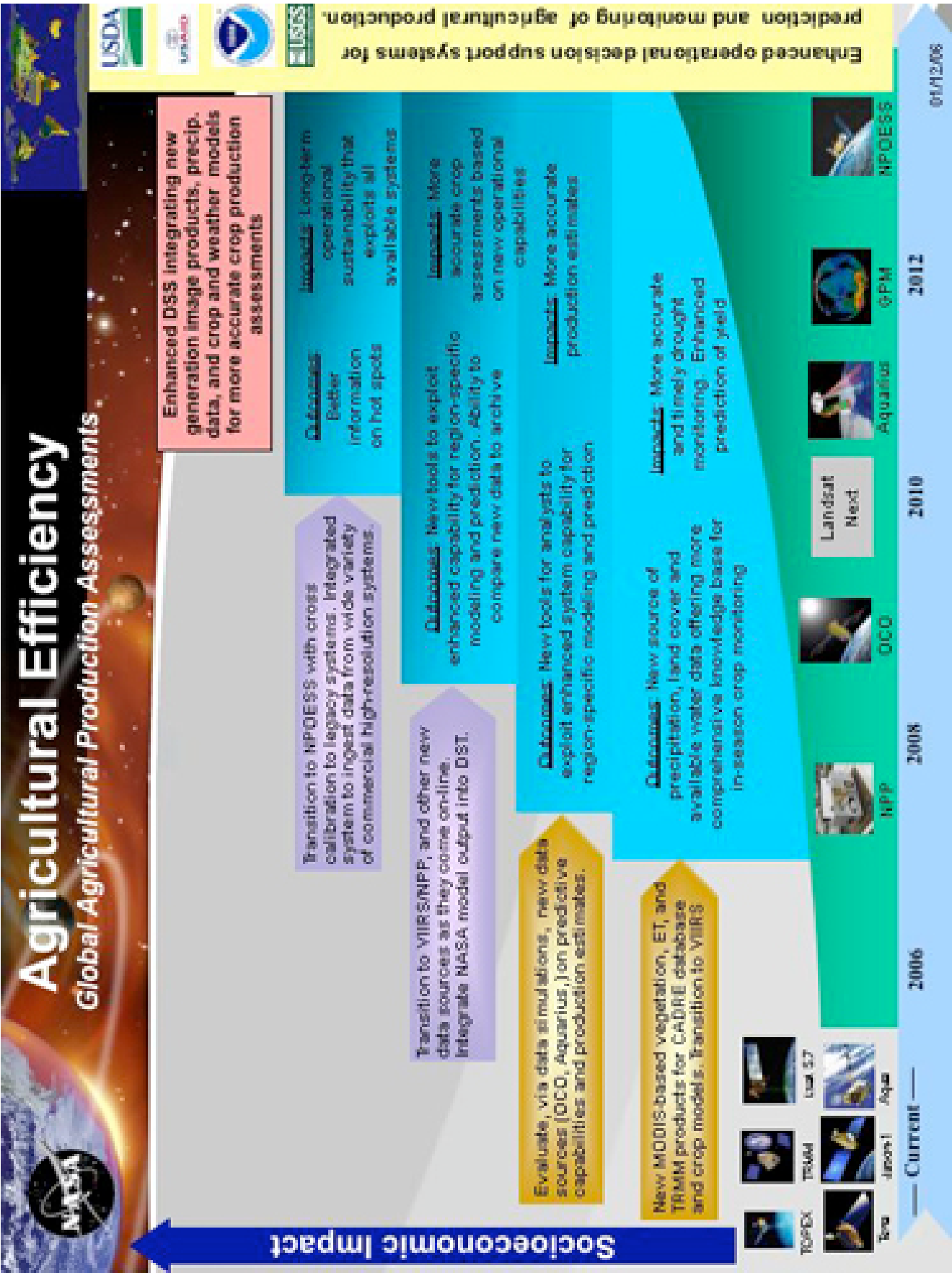
A. Integrated System Solutions Diagram

The figure below illustrates how Science measurements, model products, and data fusion techniques support the Agricultural Efficiency Program's partners and their decision support tools and shows the value and benefits of Science to society.



B. Roadmap

The roadmap for the agricultural efficiency program element illustrates how NASA capabilities in Earth observation, measurement, modeling and systems engineering are exploited systematically to improve the decision support systems and tools of USDA and other agencies and organizations making policy and resource decisions for agriculture. The roadmap focuses on USDA, base-lining current capabilities and benchmarking improvements as such improvements are integrated into USDA's operational procedures. In FY04 the primary activity was the integration and evaluation of MODIS, TRMM, Topex/Poseidon and Jason-1 products. Beginning in FY05 and continuing in FY06, data from new systems will be evaluated, initially through simulations, then through analysis of the data when available. Several planned NASA Earth science missions have the potential to impact USDA decision support tools and systems. These missions include Orbiting Carbon Observatory (OCO), and Aquarius. The OCO provides space-based observations of atmospheric carbon dioxide (CO₂), the principal anthropogenic driver of climate change. This mission uses mature technologies to address NASA's highest priority carbon cycle measurement requirement. OCO generates the knowledge needed to improve projections of future atmospheric CO₂. Aquarius is a focused spacecraft mission to measure global sea surface salinity (SSS). Aquarius will resolve missing physical processes that link the water cycle, the climate, and the ocean. The Aquarius science goals are to observe and model the processes that relate salinity variations to climatic changes in the global cycling of water and to understand how these variations influence the general ocean circulation. The Roadmap shows the major events in the chronology toward evaluation of these sources of data and information and the progression of the data toward improved decision support systems and tools over the next ten years.



C. Applied Sciences Program Budgets FY2006-10

The following figures represent the FY06 budgets for the respective Program Elements; they do not represent the entire Applied Sciences Program budget. There is an additional \$8.95million in Congressionally-directed activities and \$5million for the Mississippi Research Consortium that these figures do not incorporate.

Program Element	FY06 Procurement Allocation
National Applications	
Agricultural Efficiency	\$ 1,955,803
Air Quality	\$ 3,116,464
Aviation	\$ 3,048,878
Carbon Management	\$ 1,544,831
Coastal Management	\$ 1,416,233
Disaster Management	\$ 2,743,760
Ecological Forecasting	\$ 3,240,170
Energy Management	\$ 1,875,253
Homeland Security	\$ 1,987,054
Invasive Species	\$ 2,241,940
Public Health	\$ 3,356,124
Water Management	\$ 1,714,341
Crosscutting Solutions	
DEVELOP	\$ 1,498,000
Geospatial Interoperability	\$ 2,400,000
Solutions Networks	\$ 2,822,000
Integrated Benchmarking System	\$ 4,500,000

The following figures show the five-year run-out for the entire Applied Sciences Program. The figures are based on the FY07 President's budget submitted to Congress. The lower line shows the target budget including agency corporate and institutional adjustments.

	2006	2007	2008	2009	2010
Present Budget Summited to Congress	53,254,855	51,049,000	50,287,000	48,588,000	48,662,000
Target After Adjustments	47,321,663	39,101,000	33,922,000	34,801,000	34,803,000

D. Related NASA and Partner Solicitations and Grants

Appendix D lists NASA Earth-Sun system science research projects, Earth science fellowships, GLOBE activities, and Earth science New Investigators related to Agricultural Efficiency activities.

Fellowships

<u>Institution</u>	<u>PI</u>	<u>Title/Subject</u>	<u>Timeframe</u>
University of California Irvine	Luz Maria Cisneros Dozal	Quantifying Sources of Soil Respiration and Their Response to Environmental Changes	2002-2006

Fellowships

<u>Institution</u>	<u>PI</u>	<u>Title/Subject</u>	<u>Timeframe</u>
University of California Berkeley	Desheng Liu	Systematic Evaluation of Machine Learning Approaches for Remote Sensing Land Cover Classification	2002-2006

Fellowships

<u>Institution</u>	<u>PI</u>	<u>Title/Subject</u>	<u>Timeframe</u>
Stanford University	Virginia Matzek	Plant Nutrients, Beyond N and P: How Will Plant Growth Rates, Leaf Traits, and Tissue Chemistry Respond to the Altered Stoichiometry of Anthropogenic Global Change?	2002-2006

Fellowships

<u>Institution</u>	<u>PI</u>	<u>Title/Subject</u>	<u>Timeframe</u>
Boston University	Weile Wang	Tracing Causality and Feedback Relations between Land Surface Temperatures and Vegetation Activity in Twenty- Years of Remote Sensing Data	2002-2006

Fellowships

<u>Institution</u>	<u>PI</u>	<u>Title/Subject</u>	<u>Timeframe</u>
University of Iowa	Mekonnen Woldemaria	Characterization of the Spatial Variability of Rainfall from Remote Sensing	2002-2006

Interdisciplinary Studies

<u>Institution</u>	<u>PI</u>	<u>Title/Subject</u>	<u>Timeframe</u>
Georgia Tech	Robert Dickinson	Using MODIS Data to Characterize Climate Model Land Surface Processes and the Impacts of Land Use/Cover Change on Surface Hydrological Processes	2002-2006

Interdisciplinary Studies

<u>Institution</u>	<u>PI</u>	<u>Title/Subject</u>	<u>Timeframe</u>
University of Wisconsin	Jonathan Foley	Agricultural Land use and the Transformation of Planet Earth: Investigating the Effects of Land use Practices on the Ecological, Biogeochemical and Hydrological Systems of the Planet	2002-2006

Interdisciplinary Studies

<u><i>Institution</i></u>	<u><i>PI</i></u>	<u><i>Title/Subject</i></u>	<u><i>Timeframe</i></u>
US Geological Survey	Thomas Loveland	The Influence of Historical and Projected Land use and Land Cover Changes on Land Surface Hydrology and regional Weather and Climate Variability	2002-2006

Interdisciplinary Studies

<u><i>Institution</i></u>	<u><i>PI</i></u>	<u><i>Title/Subject</i></u>	<u><i>Timeframe</i></u>
Pennsylvania State University	Gary Peterson	Applying MODIS Parameters for Crop Yield Modeling	2002-2006

E. Acronyms and Websites

ACRONYMS:

AgriSTARS	Agriculture and Resources Inventory Surveys through Aerospace Remote Sensing
AIS	Agricultural Information System
AIWG	Applications Implementation Working Group
Aqua	Earth Observing Systems spacecraft
Aquarius	Mission to measure global Sea Surface Salinity
AVHRR	Advanced Very High Resolution Radiometer
CADRE	Crop Assessment Data Retrieval and Evaluation
CCSP	Climate Change Science Program
CCTP	Climate Change Technology Program
CO2	Carbon Dioxide
COTR	Contracting Officer's Technical Representative
DAAC	Distributed Active Archive Center (Data Active Archive Center)
DEVELOP	No longer an acronym
DSI	Disease Severity Index
DSS	Decision Support Systems
DST	Decision Support Tool
ESA	Earth Science Applications
ESG	Earth-Sun Gateway
EVI	Enhanced Vegetation Index
FAS	Foreign Agricultural Service
FEA	Federal Enterprise Architecture
FSA	Farm Service Agency
FY	Fiscal Year
GES	Goddard Earth Sciences
GIG	Global Information Grid
GISS	Goddard Institute for Space Studies
GPM	Global Precipitation Measurement
GRI	Global Reporting Initiative/Geospatial Research Institute
GSFC	Goddard Space Flight Center
GSI	Geoscience Standards and Interoperability
Hydros	Hydrosphere State Mission
IBPD	Integrated Budget and Performance Document
JCSDA	Joint Center for Satellite Data Assimilation
LACIE	Large Area Crop Inventory Experiment
LST	Land Surface Temperature
MODIS	Moderate Resolution Imaging Spectroradiometer
MOU	Memorandum of Understanding
NACP	North American Carbon Program
NASA HQ	NASA Headquarters
NASA	National Aeronautics and Space Administration
NASS	National Agriculture Statistics Service

NBARS	Nadir BRDF Adjusted Reflectance (from MODIS)
NESDIS	National Environmental Satellite Data Information Service
NOAA	National Oceanic and Atmospheric Administration
NRA	NASA Research Announcement
NRCS	National resource Conservation Service
NSF	National Science Foundation
NWS	National Weather Service
OAR	Office of Oceanic and Atmospheric Research
OCO	Orbiting Carbon Observatory
OMB	Office of Management and Budget
OSSE	Observing System Simulation Experiment
OSTP	Office of Science and Technology Policy
PART	Program Assessment Rating Tool
PECAD	Production Estimates and Crop Assessment Division
R2O	Research to Operations Network
REASoN	Research, Education, and Applications Solutions Network
RMA	Risk Management Agency
SEA	State Enterprise Architecture
SMI	Surface Moisture Index
SPOT	French Satellite which Collects Information on Arousal and Ozone
SSC	Stennis Space Center
SSS	Sea, Surface, Salinity
Terra	Not an Acronym
TOVAS	TRMM Online Visualization and Analysis System
TRMM	Tropical Rainfall Measurement Mission
UCAR	University Corporation for Atmospheric Research
USAID	United States Agency for International Development
USDA	US Department of Agriculture
V&V	Verification and Validation
VI	Vegetation Index
VIIRS	Visible/Infrared Imager/Radiometer Suite
WAOB	World Agricultural Outlook board
WFP	World Food Program

WEBSITES:

AIWG: <http://aiwg.gsfc.nasa.gov>

Applied Sciences Program: <http://science.hq.nasa.gov/earth-sun/applications>

DEVELOP: <http://develop.larc.nasa.gov>

Earth-Sun System Gateway (ESG): <http://esg.gsfc.nasa.gov/>

Earth-Sun Science System Components: <http://www.asd.ssc.nasa.gov/m2m>

NASA FY2005 Budget: <http://www.ifmp.nasa.gov/codeb/budget2005>

Research and Analysis Program: <http://science.hq.nasa.gov/earth-sun/science/>

Science Mission Directorate: <http://science.hq.nasa.gov>

Science Strategies: <http://science.hq.nasa.gov/strategy/>